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⑥ US ARMY RIGID WALL 8'x8'x20' SHELTERS

*ft* AND

US MARINE CORPS 8'x8'x20' RIGID WALL AND KNOCKDOWN

SHELTERS

⑨ INDEPENDENT EVALUATION REPORT (IER)

by

US Army Quartermaster School

⑩ October 1978

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INDEPENDENT EVALUATION REPORT (IER)

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ABSTRACT

↓ A need existed to determine the operational effectiveness and military utility of the proposed US Army ISO configured rigid wall shelters and the US Marine Corps ISO configured rigid wall and knockdown shelters. A military potential type test was conducted with the Army shelters in 1975 and 1976 and a Force Development Test Evaluation (FDTE) took place in 1978 on the US Marine Corps ISO shelters. The tests and evaluation include unloading, erecting/expanding/complexing, striking, loading and transportability, and the maintenance implications. The purpose of the tests and evaluation is to determine if the shelters should be considered as candidates for the Army family of rigid wall standard shelters. The IER recommendation states that the US Army nonexpandable, one-side and two-side expandable, and 50-foot expandable shelters are acceptable as candidates for the Army family of rigid wall shelters and the US Marine Corps shelters be considered further as candidates for the Army family of shelters.

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## SUMMARY

### INDEPENDENT EVALUATION REPORT (IER) ON THE US ARMY RIGID WALL 8'x8'x20' SHELTERS, US MARINE CORPS 8'x8'x20' RIGID WALL AND KNOCKDOWN SHELTERS

#### 1. Purpose and Scope:

a. The purpose is to determine the operational effectiveness and military utility of the shelters. To provide data for the evaluation, field tests were designed to include unloading, erecting/expanding/complexing, striking, loading, transportability in the use of the shelters, and to determine the maintenance implications. Additional data was obtained on the functional uses for some of the shelters.

b. When the ROC for the Army family of rigid wall shelters was approved in July 1974, DA requested that an evaluation be conducted of the US Marine Corps small shelters. As the result of a survey of the Army family of rigid wall shelters, a letter from HQ TRADOC to HQDA, dated 1 Nov 76, stated that three of the seven rigid wall shelters included in the approved ROC for development required deletion and to add to the ROC the US Marine Corps 8'x8'x20' knockdown shelter. The letter did not state that the ROC should be changed to include the US Marine Corps 8'x8'x20' rigid wall shelters, which is the same size as the Army 8'x8'x20' nonexpandable rigid wall shelter. The IER includes the evaluation of the US Marine Corps rigid wall and knockdown shelters and the remaining four Army rigid wall shelters in the approved ROC.

(1) Feasibility type tests for the Army rigid wall 8'x8'x20' American National Standards Institute (ANSI)/International Standards Organization (ISO) shelters were completed in 1975 and 1976. These test reports are the primary source of data for the Army rigid wall shelters:

(a) TRADOC Combined Arms Test Agency (TCATA) Test Report No. FM 303 titled "2-for-1 Expandable ISO SPAM Shelter," dated 17 June 1976.

(b) Modern Army Selected Systems Test Evaluation and Review (MASSTER) Test Report No. FM 301, titled "Improved Shelters," dated 31 December 1975. The test report includes the 8'x8'x20' two-side expandable shelter.

(c) TCATA Test Report No. FM 302, titled "50-Foot Expandable ISO Shelter," dated 14 September 1976.

(d) The nonexpandable 8'x8'x20' shelter was not field tested.

(2) The US Marine Corps shelters were tested by USAACEBD for concept under a Force Development Test Evaluation (FDTE). The test report was published in the form of a Final Letter Report, dated August 1978.

## 2. System Description.

### a. Concept of Employment:

(1) The shelters will be used by units whose mission justifies the need for a rigid wall shelter for use in the field. Some of the functions which may be performed in the shelter are administration, data processing, communication, fire control, maintenance, medical, storage, supply, and housing. The functions performed in the shelters must be capable of being accomplished in one of the standard shelters to minimize the requirement for special shelters. The ANSI/ISO specifications will provide the capability of movement by commercial and military transportation and handling equipment. Shelters will be continuously in use when the unit is in the field.

(2) Shelters will be transported within the overseas theater by rail, water, highway, and air modes. Military container transport and handling equipment, compatible with ANSI/ISO standards for cargo containers, are being developed. The fielding of this system will provide the Army in the field with a transport and handling capability for rigid wall shelters. In addition, these shelters will be capable of being dismounted from their transporters.

### b. A brief description of the shelters included in the IER:

(1) The Army rigid wall nonexpandable ISO shelter measures 8'x8'x20' in both the transport and operational configuration with a floorspace of approximately 140 square feet. The panels (roof, sides, end walls, and floor) have a paper honeycomb core impregnated with resin and faced with aluminum sheets. Empty weight is approximately 4,200 pounds and the gross weight shall not exceed 15,000 pounds.

(2) The Army rigid wall one-side expandable ISO shelter measures 8'x8'x20' in the transport configuration and approximately 8'x15'x20' in the operational configuration. The panels (roof, sides, end walls, and floor) have a paper honeycomb core impregnated with resin and faced with aluminum sheets. One side of the container is unfolded to form the shelter in the operational configuration with an expanded floorspace of approximately 270 square feet. Empty weight is approximately 4,500 pounds and the gross weight shall not exceed 15,000 pounds.

(3) The Army rigid wall two-side expandable ISO shelter measures 8'x8'x20' in the transport configuration and approximately 8'x21'x20' in the operational configuration. Two sides of the container are unfolded to form the shelter in the operational configuration with an expanded floorspace of approximately 375 square feet. The panels (roof, sides, end walls, and floor) have a paper honeycomb core impregnated with resin and faced with aluminum sheets. The shelter has an empty weight of 5,500 pounds and the gross weight shall not exceed 15,000 pounds.

(4) The Army rigid wall 50-foot expandable ISO shelter is transported in the contracted ISO container 8'x8'x20' configuration. In the operational configuration the shelter measures approximately 8'x50'x20' and provides 925 square feet of usable floorspace. The two outer sections are formed by the deployment of two sets of packaged panels and two accordion type shells. The container, floor panels, and end walls are of rigid construction, having a paper honeycomb core impregnated with resin and faced with aluminum sheets. The shells have a steel-faced foam sandwich construction protected with a protective film. Empty weight of the shelter is 8,500 pounds and the gross weight shall not exceed 15,000 pounds.

(5) The Marine Corps rigid wall ISO shelter measures 8'x8'x20' in both the transport and operational configuration. This shelter and the Marine Corps knockdown shelter are designed to be joined (complexed) continuously as needed side by side (wall to wall) and two wide end to end. The container roof has a paper honeycomb core faced with aluminum sheets. The side and end wall panels have a paper honeycomb core faced with plywood sheets. Empty weight of the shelter is approximately 4,000 pounds.

(6) The Marine Corps knockdown shelter measures 8'x8'x20' in the operational configuration and this shelter and the Marine Corps rigid wall are designed to be joined (complexed) continuously as needed side by side (wall to wall) and two wide end to end. The shelters in their transport configuration are stacked four high to form a standard configuration (8'x8'x20'). The roof and panels have a paper honeycomb core faced with plywood sheets. Empty weight of each shelter is approximately 4,000 pounds.

### 3. Limitations:

a. Other than basic information concerning the technical aspects of the Army rigid wall shelters the data source is limited to the data in the test reports. The limitation holds true for the data on the Marine Corps shelters with the exception that the contractor's Summary Reports, prepared for the US Marine Corps on the design and test program, were available.

b. The US Army had no previous development experience with the Marine Corps shelters prior to the FDTE.

c. A Maintenance Test Support Package (MTSP) was not available for any of the tests and it was not a requirement for the field test of the Army rigid wall shelters.

### 4. Adequacy of Testing in Providing Data:

a. The data from the feasibility tests of the Army shelters and the FDTE of the Marine Corps shelters are adequate for assessing potential military utility/operational effectiveness for the initial independent evaluation but further testing is required to assess RAM and logistic supportability.

b. The Army nonexpandable 8'x8'x20' shelter has not been tested, however, similar data are available from the feasibility test of the Army one-side expandable, two-side expandable and 50-foot expandable shelters and from other sources.

5. Operational Issues:

a. The critical issues tested are:

(1) Can the Marine Corps shelters, in various configurations (rigid w/ knockdown, knockdown, 2 knockdowns), be transported by rail, sea, highway, and air modes? The shelters were tested only for field operations with helicopters, flatbed semitrailers, and dolly sets.

(2) Can the shelters be erected and struck within acceptable time limits without special handling equipment during day and night operations?

(3) Are the safety, training, and human factors implications within acceptable limits?

b. The critical issues not tested are:

(1) Can logistic supportability be provided to the candidate shelters?

(2) Do the shelters possess adequate RAM?

These critical issues will be addressed in further tests as determined to be needed.

6. Analysis (Critical Test Issues).

a. Transportability.

Type Shelter	Helicopter	Flatbed Semitrailer	Dolly Set
(1) Nonexpandable * (8'x8'x20')	**	**	**
(2) One-side expandable	Acceptable	*	Acceptable
(3) Two-side expandable	Acceptable CH-47	Acceptable	Acceptable
(4) 50-foot expandable	Acceptable CH-47	**	Acceptable
(5) Marine Corps rigid wall (8'x8'x20')	Acceptable CH-54	Acceptable	***
(6) Marine Corps knockdown	Acceptable CH-47, CH-47C	Acceptable	***

- \* Shelter not available.
- \*\* Data not available.
- \*\*\* An attachment was not available on the shelter to fasten the dolly set.

b. Erecting/striking. (Requirement of erecting/striking within four man-hours (mh) per 160 square feet).

(1) Data for times to erect and strike at night for the one-side expandable are not available. The times required to erect and strike the one-side expandable during daylight and two-side expandable are within the stated requirement. The 50-foot expandable was erected during daylight in an average of 30.03 man-hours and at nighttime in an average of 36.47 man-hours using 8 to 10 men. The shelter was struck during daylight in an average of 21.03 man-hours and at nighttime in an average of 21.67 man-hours using 8 to 10 men. These times can be compared with the ROC which allows a maximum of 25 man-hours for either erecting or striking. The times required for erecting and striking the Marine Corps shelters are within the stated requirement or an acceptable level. (Data on times for erecting and striking at night are not available.)

(2) The Army nonexpandable, one-side expandable, two-side expandable, 50-foot expandable shelters can be erected and struck without special tools/handling equipment during day and night operations. There is no requirement for the special tools/handling equipment for these operations. (It should be noted that the weight of these shelters prohibits the movement of the shelters, such as a few feet or more, without special tools/handling equipment.) The Marine Corps rigid wall and knockdown shelters, each as a single unit, can be erected and struck with and without special tools/handling equipment during day operations and night operations with adequate lighting. Special tools/handling equipment are required to erect/complex and strike these shelters during day operations and night operations with adequate lighting.

(3) The data available from the test reports are insufficient to adequately evaluate the leveling device to level the shelters over a terrain a minimum of 18 inches. The leveling device to be provided for the Army candidate shelters needs further engineering development and will be further evaluated during DT II and OT II. Further engineering development is currently taking place.

c. Safety, training, logistics, and human factors implications of the shelters.

	<u>Safety</u>	<u>Training</u>	<u>Logistics</u>	<u>Human factors</u>
<b>Army shelters</b>				
Non- * expandable	Satisfactory	Minimal required	Satisfactory	Satisfactory
One-side	Satisfactory	Minimal required	Satisfactory	Satisfactory
Two-side	Satisfactory	Minimal required	Satisfactory	Satisfactory

	<u>Safety</u>	<u>Training</u>	<u>Logistics</u>	<u>Human factors</u>
50-foot	Avoidable <sup>1</sup>	Minimal required	Satisfactory	Satisfactory <sup>2</sup>

Marine Corps shelters

Rigid wall	Conditionally <sup>3</sup> Minimal satisfactory	Minimal required	Satisfactory <sup>4</sup>	Conditionally <sup>3</sup> satisfactory
Knockdown	Conditionally <sup>3</sup> Minimal satisfactory	Minimal required	Conditionally <sup>4</sup> satisfactory	Conditionally <sup>3 4</sup> satisfactory

\*Data available from the feasibility tests of the other Army rigid wall shelters and from other sources.

NOTES:

1. Safety hazards associated with field operations are reasonably avoidable if personnel are aware of them.
2. Interior lighting is unacceptable as tested.
3. Erecting/complexing and striking as determined by the ACEBD. are unsafe for hours of darkness and rainy/wet conditions. Other safety hazards consist of personnel lifting the knockdown shelter roof section, lack of adequate holding devices on end and side walls, handling fiberglass materials, roof access and nonskid floor material.
4. Special tools/handling equipment are required to erect/complex and strike the rigid wall and knockdown shelters. The requirement to lift the roof by 15 personnel is excessive weight per personnel when erecting/complexing and striking. The weight of the roof is approximately 1,000 pounds which would require 20 personnel. MHE is needed to move the roof section.

7. Conclusions.

a. Testing required:

- (1) The durability of the panel sections and other laminated material sections of the Marine Corps shelters requires further technical evaluation.
- (2) DT II/OT II of the candidate shelters required for performance characteristics, RAM and logistics supportability.

b. Problem areas requiring additional developmental attention:

- (1) One-side expandable: The major findings as indicated in the test report should be reviewed for inclusions in the development cycle of the shelter. These findings as enumerated in the test report are low risk.

(2) Two-side expandable: The major findings as enumerated in the test report are low risk and should be reviewed for inclusion in the design of the shelter.

(3) 50-foot expandable: The shelter is fragile and easily damaged; although, users are capable of making most repairs. This is a potential logistics problem. Erecting times exceeded the ROC requirement. The shelter is not suitable for tactical operations requiring frequent and rapid movement.

(4) Marine Corps rigid wall and knockdown:

(a) Further assessment of the engineering development and funds would be required to correct the deficiencies/shortcomings. These findings are low risk with the exception of the durability of the panel sections and other laminated materials. The available data does not provide the information to state the possible risk associated with laminated materials. The deficiencies/shortcomings involve panel side fasteners, roof access, storing of excess panels and other support materials when the shelters are erected/complexed, handles on panels, side tolerance of panels when in place, roof drainage, several problems with the complexing kit (includes changing packaging configuration in the transport configuration), and frayed outer surface.

(b) An ACEBD Safety Committee assessed the potential safety hazards associated with erecting and striking the Marine Corps 8'x8'x20' knockdown shelters. The potential safety hazard areas identified include method of sliding the end walls into place, experienced personnel required to emplace the end posts and roof section, securing side walls with roof, night operations, handholds on side and end walls, roof access, and safety markings.

8. Operational Effectiveness/Military Utility.

a. The nonexpandable rigid wall shelter can support communications equipment and general purpose functions in the field.

b. The one-side expandable and two-side expandable shelters can support general purpose functions in the field.

c. The 50-foot expandable shelter after further development potentially can support the planned uses by units whose missions justify the need for mobile rigid wall shelters of this size.

d. Marine Corps 8'x8'x20' rigid wall shelter.

(1) The utility which can be provided by the Marine Corps 8'x8'x20' rigid wall shelter can be provided by the Army 8'x8'x20' rigid wall nonexpandable shelter.

(2) The purpose for the development of the Army family of rigid wall shelters is to curtail the proliferation of rigid wall shelters.

(3) At the present time, no urgent replacement need in the field has been established for this size shelter.

(4) The Marine Corps shelter would require different support needs such as repairs and replacement of parts and has different construction techniques. These repairs and replacement parts required for the Army nonexpandable shelter exists for the Army one-side expandable and two-side expandable shelters. All of these Army shelters have the same construction/construction materials for like panels/sections and parts.

(5) The Army one-side expandable shelter is scheduled for DT II/OT II in 1979. The testing of this shelter will preclude the necessity for testing of the Army nonexpandable shelter because of similarity in construction. The Army 8'x8'x20' nonexpandable rigid wall shelter can be provided to the troops in the field for use at an earlier date than the Marine Corps 8'x8'x20' rigid wall shelter. The materiel developer has substantiated this statement.

e. Marine Corps knockdown shelter.

(1) The concept of the shelter provides a mobile shelter for field use and by complexing can provide additional floorspace under a single roof. However, the erection/complexing and striking of the rigid wall and knockdown shelters require the field support of special tools/handling equipment. The Marine Corps knockdown shelters can only be used in units which can provide the handling equipment support. Army units that can provide the MHE required for erecting/complexing and striking are maintenance, supply, and storage units.

(2) An ACEBD Safety Committee assessed the potential safety hazards associated with erecting and striking the Marine Corps 8'x8'x20' knockdown shelters. The potential safety hazard areas identified include method of sliding the end walls into place, experienced personnel required to emplace the end posts and roof section, securing side walls with roof, night operations, handholds on side and end walls, roof access, and safety markings.

9. Recommend that:

a. The nonexpandable, one-side expandable, two-side expandable, and 50-foot expandable be accepted as candidates for the Army family of rigid wall shelters.

b. The Marine Corps rigid wall shelter be considered as a candidate shelter for the Army family of rigid wall shelters.

c. The Marine Corps knockdown shelter be considered as a candidate for the Army family of rigid wall shelters for use by units with special tools/handling equipment. The consideration as a candidate shelter is subject to further technical evaluation by the materiel/combat developers.

d. Further evaluation of the candidate shelters be made during OT II and DT II.